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radio frequency voltage having a second phase offset from said first phase is applied between said electrically conductive enclosure and said grounded casing.

IN THE SPECIFICATION:

Page 9, lines 15-28: ~~It is important to note that inasmuch as the present~~
invention utilizes RF energy to create a plasma and to process materials, electrically conductive enclosure 11 does not necessarily need to be grounded. In some circumstances it may be desirable to have electrically conductive enclosure 11 floating and apply RF energy at some predetermined phase, which can differ by as much as 180°, with respect to RF energy applied to electrode 13, to enhance the effectiveness of the processing. In this situation, a protective, grounded casing 14, shown by dashed lines in Figure 1, would enclose the invention for safety reasons. An appropriate frequency for the RF energy used in the present invention is 13.56 Megahertz (MHz), however other RF frequencies might also prove useful.

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REMARKS

Reconsideration of the above-referenced application is respectfully requested.

Briefly, the present invention provides atmospheric pressure plasma processing of materials with the added benefit of ion chemistry. The apparatus of the invention accepts a material to be processed either between a radio-frequency electrode and a ground electrode or the material itself is the ground electrode. The invention working at atmospheric pressure effectively processes substrates, such as silicon wafers, or providing cleaning of spools and drums through the use of an inert gas and a chemically reactive gas.

The Examiner initially objected to the drawings under 37 CFR 1.83(a) for failing to show the "ground enclosure" as that phrase is used in the original claims. A Proposed Drawing Correction is being submitted contemporaneously that illustrates in red this now named "grounded casing."

Next, the Examiner rejected Claim 2 under 35 U.S.C. §112 because insufficient antecedent basis existed for "said means for placing said material to be processed." Herein, Claim 2 has been amended to provide a proper antecedent basis.

The Examiner then rejected Claims 1-6 and 9-14 under 35 U.S.C. §102(b) as being anticipated by the Wooley et al., patent (U.S. Patent No. 5,743,966). The applicants respectfully traverse this rejection.

Wooley et al., teaches a low pressure plasma created in an evacuable chamber to deposit a coating on plastic films. Gas is flowed toward the area where the web is unwound from the drum in order to avoid buildup of static on the moving material that causes the web to stick to the drum. This problem is common in reduced-pressure plasma operations and can cause power supply dropouts. These gases form a plasma that provides a path for dissipation of the static charge on the web; it is this static charge that causes the sticking of the web and the attendant problems. Wooley et al., discloses the use of an operating pressure of 20-30 microns in the baffle area, 1-2 microns of gas pressure in the winding zone, and 50-100 microns gas pressure in the deposition region.

The web sticking problem addressed by Wooley et al., does not occur at atmospheric pressure, due to the much greater collision frequency of gas molecules with the film and the rotating drum. These higher collision rates help to dissipate surface charge that causes the sticking experienced at low pressures. Hence, with the present invention, there is no need for separate plasma chambers, such as a winding region and a deposition region, for treatment of materials at atmospheric pressure.

Amended Claims 1 and 9 now clearly indicate the nature of the plasma created by the present invention at atmospheric pressure. Since Wooley et al., teach a reduced-pressure enclosure and plasma, it cannot anticipate the claims of the present invention. Therefore the Examiner's rejection cannot stand.

Further, Claims 2-6 and 10-14 depend from Claims 1 and 9. As Claims 1 and 9 are considered to be allowable, the Examiner's rejection of Claims 2-6, and 10-14, also cannot stand.

The Examiner next rejected Claims 1-6 under 35 U.S.C. §103(a) as being unpatentable over Fales (U.S. Patent No. 3,959,104) in view of Wooley et al., (U.S. Patent No. 5,743,966). The applicants respectfully traverse this rejection.

Fales, like Wooley et al., teaches an evacuated enclosure for production of a plasma. Fales neither teaches nor suggests operation at atmospheric pressure. In

fact, Fales teaches away for atmospheric pressure operation (Col 2, lines 27-50). As stated above, Wooley et al., also fails to teach or suggest atmospheric pressure operation, its combination with Fales cannot render applicants' claims, as amended, obvious. Also neither Fales nor Wooley et al., teaches an atmospheric pressure plasma having uniform glow properties. As stated previously, Claim 1 has been amended herein to clearly indicate the atmospheric pressure nature of the plasma created by the present invention. Thus the Examiner's rejection of Claim 1 cannot stand.

Claims 2-6 depend from Claim 1, as amended. These claims are now considered to be allowable due to the amendment of Claim 1.

The Examiner then rejected Claim 15 under 35 U.S.C. §103(a) as being unpatentable over Wooley et al., as above applied to Claims 9-14, and in view of no other references. The applicants respectfully traverse this rejection.

The Examiner argues that, although Wooley et al., do not teach operation at 13.56 MHz, it would be obvious to one of ordinary skill in the art at the time the present invention was made to vary the ac frequency as a process parameter under normal operation. However, the Examiner fails to point out any teaching of Wooley et al., to this end. In fact, the applicants have been unable to find any teaching or suggestion in Wooley et al., concerning any benefit to varying the input power other than to a very specific voltage and current. The Examiner also argues that the manner in which an apparatus is operated is not a patentable trait over prior art with identical structure, But applicants' claims, as amended, do relate to an invention having identical structure to Wooley et al. In any case, Claim 15 depends from Claim 9 (Amended), and as Claim 9 (Amended) now is considered to be allowable, Claim 15 also should be allowable. Therefore, the Examiner's rejection cannot stand.

The applicants appreciate the Examiner's indication that Claims 7, 8, 16, and 17 would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, as applicants feel that all claims in this case should be allowable, no rewriting of these claims is necessary.

Herein, Claims 1, 2, 7, 9 and 16, and the specification have been amended to overcome the Examiner's rejections under 35 U.S.C. §112, and to more particularly

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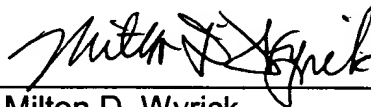
Docket No. S-91,756

In Response to Office Action dated June 3, 2002

claim the present invention in a sincere effort to move this case to allowance. For the reasons stated, and for other reasons inherent herein, the Wooley et al., and Fales references, either alone or in combination, fail to anticipate, teach or suggest the novel aspects of the present invention as disclosed and set forth in applicants' claims as amended. Because of this, Claims 1-17, as amended, are considered to be allowable.

Therefore, this application is considered to be in condition for allowance, and such action is earnestly solicited.

Respectfully submitted,



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**MARKED UP VERSIONS OF THE AMENDED CLAIMS
AND AMENDED PARAGRAPH OF THE SPECIFICATION**

IN THE CLAIMS:

Claim 1 (Amended) Apparatus for processing materials in an atmospheric pressure radio-frequency non-thermal plasma comprising:

an electrically conductive enclosure defining an interior space with a surface and openings for introductions of a gas and for entry and exit of a material to be processed;

an electrode situated inside said interior space and spaced apart from said surface of said interior space a distance sufficient to allow placement of said material to be processed;

a mechanical action for placing said material to be processed inside said interior space on said electrode or between said electrode and said electrically conductive enclosure;

wherein a gas is introduced into said interior space through said opening for introduction of a gas and a radio-frequency voltage applied between said electrically conductive enclosure and said electrode creates [a] an atmospheric pressure plasma in said interior space for processing said material to be processed within said electrically conductive enclosure.

Claim 2 (Amended) The apparatus as described in Claim 1, wherein said [means] mechanical action for placing said material to be processed comprises a roller.

Claim 7 (Amended) The apparatus as described in Claim 1, wherein said apparatus is enclosed by a [ground enclosure] grounded casing and a first radio frequency voltage having a first phase is applied between said electrode and said [ground enclosure] grounded casing and a second radio frequency voltage having a second phase offset from said first phase is applied between said electrically conductive enclosure and said [ground enclosure] grounded casing.

Claim 9 (Amended) Apparatus for processing materials in an atmospheric pressure radio-frequency non-thermal plasma comprising:

an electrically conductive enclosure defining an interior space with a surface and inlets for a gas and for entry and exit of a material to be processed;

an electrode spaced apart from said electrically conductive enclosure and capable of placing said material to be processed inside said interior space between said electrically conductive enclosure and said electrode, said material to be processed being in contact with said electrode;

wherein a gas introduced into said inlet for gas and a radio-frequency voltage applied between said electrically conductive enclosure and said electrode creates [a] an atmospheric pressure plasma in said interior space for processing said material to be processed as it passes through said electrically conductive enclosure.

Claim 16 (Amended) The apparatus as described in Claim 9, wherein said apparatus is enclosed by a [ground enclosure] grounded casing and a first radio frequency voltage having a first phase is applied between said electrode and said [ground enclosure] grounded casing and a second radio frequency voltage having a second phase offset from said first phase is applied between said electrically conductive enclosure and said [ground enclosure] grounded casing.

IN THE SPECIFICATION:

Page 9, lines 15-28: It is important to note that inasmuch as the present invention utilizes RF energy to create a plasma and to process materials, electrically conductive enclosure 11 does not necessarily need to be grounded. In some circumstances it may be desirable to have electrically conductive enclosure 11 floating and apply RF energy at some predetermined phase, which can differ by as much as 180°, with respect to RF energy applied to electrode 13, to enhance the effectiveness of the processing. In this situation, a protective, grounded casing 14, shown by dashed lines in Figure 1, would enclose the invention for safety reasons. An appropriate frequency for the RF energy used in the present invention is 13.56 Megahertz (MHz), however other RF frequencies might also prove useful.